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Emerging diagnostic imaging technologies

Diagnostic Imaging Technology Watch | 2020 Volume 1

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Disclaimer: Vizient® staff attend clinical sessions at important scientific meetings throughout the year. The staff meet with suppliers, review new technologies and monitor data from pertinent clinical trials. The information is consolidated into this overview of product and practice trends. This document is intended to educate nonclinical hospital staff by offering insights into new and innovative technologies. Vizient staff members have no personal financial connections with the suppliers and no conflicts of interest in the development of this document. The products and trends presented are for educational purposes. Vizient does not endorse any of the products described in this document.

Introduction

The Vizient Diagnostic Imaging Technology Watch is intended to educate and provide insights into new and innovative technologies that support delivery of the highest-quality care. This issue highlights products available in the market, as well as emerging technologies. It also offers Vizient® pricing projections and featured supplier summaries.

Market watch

The road to payment reform: a guide to PAMA compliance for advanced imaging

Policymakers have faulted overuse of advanced imaging modalities as a factor contributing to unsustainable levels of U.S. health care spending. That scrutiny was the driving force behind the passage of the Protecting Access to Medicare Act of 2014 (PAMA). This federal law includes a mandate from the Centers for Medicare & Medicaid Services (CMS) that ordering physicians consult appropriate use criteria (AUC) using a qualified Clinical Decision Support Mechanism (CDSM) when ordering advanced imaging procedures such as CT, MRI, nuclear medicine and PET/CT. Following a one-year education and testing period in 2020, the punitive measures of PAMA were expected to take full effect on Jan. 1, 2021.

On Aug. 12, 2020, however, CMS announced that the educational and testing period will be extended by one year through 2021. Whether or not this extension is related to COVID-19 considerations is unclear, but could likely be a contributing factor in this decision from CMS. Despite this extension, providers should not delay implementing a compliant CDSM system in time to be up and running by the time punitive measures take effect. This article has been edited to reflect the availability of Medicalis CDSM software on the new Siemens Clinical Informatics Agreement XR0607 effective Feb. 1, 2020.

For most providers, the road to organizational compliance with this mandate, and the effect it will have on their reimbursement, is still unknown. In order to meet the compliance deadline and avoid reimbursement penalties, diagnostic imaging administrators will need to gather support, build a system and maintain compliance.

Gather support for the change

Gathering support begins with engaging physicians. Since they will be interacting with the CDSM, ordering physicians and their staff will need support for using CDSM tools, along with a reliable point of contact for questions when ordering advanced imaging procedures for Medicare beneficiaries. Current CDSM platforms do not provide a hard stop to providers who order an inappropriate exam, but only track the National Provider Index of physicians who consistently force orders that are contrary to appropriate use criteria. If you're wondering which referring physicians to focus your outreach on, CMS has provided a list of priority clinical areas where CDSM mechanisms will have the most impact.

Many times, exams that are forced through the mechanism can reveal opportunities for ordering physicians to be consulted, preferably by a radiologist peer, toward a more appropriate exam. With radiologist oversight, exam protocols can be standardized across modalities and matched up with appropriate use criteria to streamline CDSM usage and guide enforcement later. It also helps to have a radiologist leader who will champion the initiative from its inception, ensure practices match policy and serve as a point of contact for referring physicians.

Collaborative relationships between ordering and service providers can enhance usage of the CDSM, increase the number of appropriate exams and mitigate future conflicts.

Build a CDSM system

Between 2014, when PAMA was passed, and the rollout date of 2021, provider-led entities (PLEs) were busy approving AUCs and providing them to CDSM platforms for use. Once the AUCs were in place, CMS began qualifying CDSM platforms that could be used alone or integrated into electronic medical records (EMRs). There are currently a variety of platforms to choose from and many important things to consider when choosing a CDSM vendor.

Start by contacting a CMS-qualified CDSM vendor to investigate CDSM options before divisional budgets are due. The cost of adding a CDSM platform is certainly justified considering the financial penalties of not using one. Be sure to keep physician leaders engaged during this phase as well. Aim for intuitive workflows that increase communication between ordering and provider physicians during order placement.

Also, remember to address those physicians who are still adamant about faxing handwritten orders — the rules and penalties still apply. Similarly, watch for non-emergent orders from the emergency department, as these will require a proactive approach to avoid conflict. Providing ordering physicians with access to approved protocols and published appropriate use criteria for provider-led entities can reduce the tendency to force exams through the CDSM mechanism.

Medicalis has been a CMS-qualified CDSM since November 2017, and offers a total solution for PAMA-AUC compliance from ordering provider to the radiology department. Currently, Medicalis is the only Vizient-contracted CDSM solution and is available on the Siemens Clinical Informatics Agreement XR0607. Siemens Healthineers hosted an informative webinar that can help get you started down the road to compliance.

Establish a process to ensure compliance

Enforcing an effective CDSM should not be a reactionary process. Imaging orders should also be reviewed well in advance of the patient arriving at the clinic and staff should be trained to proactively identify and manage inappropriate orders.

Designate a CDSM team that consists of an imaging staff member or manager, a radiologist, a scheduler and a billing and coding representative. This team should be responsible for receiving, reviewing and managing imaging referrals to completion.

Also, don't forget about the patient. The last thing you want is a patient finding out their exam has not been approved after they arrive for their appointment. Be proactive and contact patients ahead of time.

Once the process is in place, track the effectiveness of the CDSM team to identify and engage physicians who are outliers and are risks for creating reimbursement penalties and denials.

Despite the CMS extension of the testing and education period, payment reform will remain the destination. The time is now to get started on CDSM implementation.

To get started on CDSM implementation, following are links to guidelines and PLE information:

- Siemens Medicalis recorded webinar: The Road to Payment Reform: A Guide to PAMA AUC Compliance for Advanced Imaging
- AUC Fact Sheet
- Appropriate Use Criteria and Timelines
- PLE information
- CDSM information
- Outreach and Education
- ACR CDSM support
- SNMMI AUC and MIPS update (2018)
- SNMMI AUC Listings
- ACR AUC Listings

Access the Vizient blog.

Economic watch

Price projections affecting the diagnostic imaging market

Table 1 shows projected supply chain price inflation projection over the next 18 to 24 months. Vizient expects overall market prices for supplies to increase 1.4% in late 2020. Table 2 shows projected changes in drug prices through June 30, 2021.

Table 1. National price inflation projections*

Product category	National price inflation projection (%)
Cardiology overall	0.6
Cardiac rhythm management	-0.7
Orthopedic overall	0.2
Orthopedic supplies	-0.2
Joint implant	-1.2
Spinal	-0.2
Trauma	1.0
Neurosurgical	1.3
Electrophysiology	2.1
IV solutions	2.5
Medical/surgical supplies	1.1
Medical equipment	1.2
Imaging equipment	0.2
Laboratory equipment	0.3
Laboratory consumables	1.0
Medical gases	4.8
Purchased services	2.5
IT hardware	-2.1
IT software	-1.3
IT services	1.0
Commercial printing	2.0
Office supplies	2.6
Furniture	3.2
Water	3.5
Electricity	1.2
Natural gas	2.2
Telephone, wireless	-2.1
Internet	0.5
Food overall	3.0
Overall projected price change	**1.4**

*The projections are for the next 18-24 months and are calculated using historical pricing trends, raw material trends, internal resources, the producer price index and the consumer price index.

Source: Vizient Budget Impact Projections Report, Q4 2019

Abbreviations: IT = information technology; IV = intravenous

Table 2. Projected drug price changes

Product group	Vizient predicted price change, %
Contract products	3.02
Noncontract products	3.88
Total weighted average drug price inflation estimate	**3.59**

Estimates based on Vizient member data for October 1, 2018-September 30, 2019. All classes of trade; excludes 340B purchases.

Source: Vizient Drug Price Forecast, Winter 2020

Technology watch

Precision medicine in medical imaging

On Jan. 20, 2015, President Barack Obama announced the launch of the Precision Medicine Initiative, a research endeavor aimed at expanding precision medicine in cancer research and incorporating it more broadly into all areas of health and health care.[1,2] Precision medicine considers variability in genes, environment and lifestyle when providing prevention and treatment strategies for various health issues.[3] The global precision medicine market was valued at more than $48.5 billion in 2018 and is expected to reach more than $84.5 billion in 2024, representing a 9.7% compound annual growth rate.[4] The drivers of this market are primarily the patient's involvement in their own health care, an increase in genetic diseases, advancements in cancer biology and the explosion of wireless technologies integrated with portable health care devices.[5] The shift to more patient-centered care and the advances of imaging technologies will bring new information to the design of treatments and could grow the precision medical imaging market from $120 million in 2017 to more than $8 billion by 2027.[6]

Database architecture and data mining are a critical component of the precision medicine initiative, and imaging offers a variety of data sources and report content. One example is DICOM images, which contain data such as radiation dose, patient demographics and study identifiers, etc. For example, the DICOM header of a breast image contains compression thickness, imaging abnormalities and other characteristics. This information could be used and analyzed to create better risk prediction models, imaging strategies for early detection, and lifestyle recommendations for prevention.[7]

According to Frost and Sullivan, a business consulting firm, the 10 big growth opportunities in precision medical imaging for imaging companies and technology vendors are[8]:

1. Evidence-based study ordering
2. Advanced imaging techniques and personalized image acquisition protocols
3. Adaptive, anatomical and applied machine intelligence
4. Precision reporting with informed and correlated study interpretation
5. Quantitative imaging and radiomics
6. Image-based, 3D-printed implants and anatomical guides
7. Real-time, image-guided interventions
8. Precise oncologic radiation dose therapy
9. Molecular imaging of theranostic radiotracers
10. Imaging study value, quality and outcomes analytics

Precision medicine is the future. Even though radiology equipment manufacturers are in various stages of adopting these technologies, the potential impact of precision medicine on patient care is tremendous.

Comfort, care and coils trending in the field of MR

Magnetic resonance (MR) imaging scanners were a game changer in the 1970s when use of the technology to produce three-dimensional anatomical images came to market. It's an expensive piece of equipment for hospitals and worth every penny for the countless lives it has saved. Here's what else has changed in recent years, what you can expect from newer models and what to look for in the future.

Patient comfort

MR devices create scans using a strong magnetic field as well as radiofrequency. These scans create detail imaging that may not be seen in other typical imaging modalities.

The coils used to detect and transmit the MR signals have historically been heavy and rigid, generally coming in three sizes, and could only be used one at a time. Recently, new coils have entered the marketplace that are similar to a heating pad or small blanket to transmit the signal. This offers greater flexibility and allows better positioning and handling for the technologist. Additionally, multiple coils can be used at once for improved coverage of the anatomy.

Researchers at the National Institute of Biomedical Imaging and Bioengineering, part of the National Institutes of Health, say flexible MRI coils may reduce the amount of time it takes to perform a scan, which, depending on the patient and the issue, can still take up to an hour. Because the patient must lie perfectly still during this time, any reduction in length of scan is an improvement.

A reduced scan time increases comfort for the patients who, on older models, must also endure loud noises and bright lights. During a typical MR scan, a patient would have to wear headphones or earplugs to withstand the noise. The sound intensity can reach up to 120 decibels in certain

MR scanners. Compare this to a motorcycle or dirt bike, whose average noise levels range from 80 to 110 decibels. The newer magnets are much quieter. You can actually have a conversation during a majority of the sequences, which would be impossible with the older models.

In addition, new MR scanners are equipped with lighting inside the core of the magnet as well as ambient lighting in some facilities, which makes the system look less intimidating and sterile-looking, as well as less frightening, especially to children. Some even have an entertainment system, including video and music. Newer MR systems are built with a larger bore, or the bore is oval in shape. The oval shape MR system accommodates the natural shape of the body at rest. Newer models also have larger tunnels and more air circulating through them to create a somewhat more pleasant experience.

Patient care

In addition to patient comfort, the new MR scanners also improve efficiency, technology and overall patient well-being. MR scanners are being used in radiation therapy to plan treatment. The MR uses the same type of table used in computed tomography (CT). MR scans have improved resolution as compared to CT scanners.

The new MR devices electronically send data, including patient positioning, to the linear accelerator. Using this data, the oncology system's radiation beams have a more precise target, and thereby reduce the amount of unnecessary radiation exposure to the patient. By bringing together MR technologists and radiation therapists with this new technology through cross-training, hospitals can achieve better clinical outcomes.

In more good news, MR devices on the market today are engineered for helium reduction. MR devices work by using electronic magnets, which must be kept at approximately 0 degrees Kelvin, and helium provides that cooling power. The problem is that helium is a finite source, and because it cannot be manufactured, once it's used, it's gone.

Nearly all the manufacturers on the market today have gone to zero boil-off, or close to it, and it can be two to three years before a system has to be refilled. Newer models are much more efficient in recapturing the helium than they were in the past.

Recently, one manufacturer developed a sealed system, which uses much less helium and doesn't require any boil-off. When it needs to be quenched, i.e., refilled, it requires only seven liters of liquid helium and it is totally sealed. This new technology further reduces the amount of helium being used in the world, which then extends the length of supply availability.

For the future, look for coil technology to improve. Coils will continue to get smaller, and vendors will continue to improve image resolution. These advancements will improve patient care and increase patient comfort.

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USP <825> delay

The highly anticipated release of USP <825>'s final version in June 2019 was the focus of nuclear departments and pharmacies across the country. As is formally required for each USP chapter, the initial announcement also indicates an implementation date of six months from the announcement. The implementation date was therefore set for Dec. 1, 2019, and thus the industry began its preparation to comply with these new recommendations. As USP <825> was the first USP chapter specifically indicated for radiopharmaceuticals, a previously exempt area, the level to which departments and pharmacies had to make changes varied drastically. With only six months to make all relevant changes, the industry began to immediately make capital purchases, change standard operating procedures and train employees on their new processes.[9]

During this time, the industry also spent time researching what those final recommendations required. As this was the first radiopharmaceutical-specific chapter, questions and challenges arose into specific requirements (such as beyond-use dates and validation), and appeals were filed that ultimately required USP <825> to be placed on indefinite hold.[10]

The appeal process for USP <825> follows similar steps and timelines to those seen during the full chapter submission. The U.S. Pharmacopeia Convention will review the appeals and decide whether to amend the chapter. Only those sections specifically being appealed will be reviewed, and the rest of the chapter will remain the same language and recommendations. Once the appeal process is completed, the "new" final version of USP <825> will be announced and indicate a new implementation date of six months from the announcement. For now, the industry will be once again eagerly awaiting the final release of USP <825> but this time will have the advantage of having a glimpse into what changes will be required within their organizations. The industry will therefore, hopefully, be ready when the new implementation date is announced in the future.[11] For more information, read our blog, Understanding the potential impacts of USP <825> for radiopharmaceutical compounding.

Clariscan

During the first week of November 2019, the Food and Drug Administration approved GE Healthcare's new product, Clariscan. Clariscan (gadoterate meglumine) is a generic version of Guerbet LLC's Dotarem. This marks the first generic, macrocyclic, gadolinium contrast entrant to the MR industry and has the potential to disrupt the market. With increased competition in the space, especially by a generic contrast agent, MR gadolinium contrast prices could potentially decline.

Supplier watch

Vizient imaging suppliers roll out innovation at the frontlines

The U.S. health care landscape continues to squeeze radiologic services under mounting costing pressures and increased patient volumes. Radiology departments have been left with no choice except to "do more with less." Imaging staff and radiologists absorb increased expectations for patient throughput and exam turnaround time, while executives look to improve financial performance and patient satisfaction scores. With the advanced ability of today's imaging equipment technology, it seems the greatest improvements in cost efficiency can be achieved via staff engagement and decreased "table" times. In response to these trends, 2019 was marked by equipment innovations from Vizient diagnostic imaging suppliers that recognize the potential of enhancing the frontline user experience. We applaud these suppliers for going beyond the mechanical and resolution specifications to expand human user ability. Ergonomically redesigned equipment setups and interactive artificial intelligence embedded at the equipment level continue to emerge in the market. While a massive focus is still attuned to streamlining image interpretation, these products show that the "upstream" workflows at the patient level can be revolutionized as well.

Siemens Healthineers

Syngo Virtual Cockpit

The Syngo Virtual Cockpit is a software platform compatible with Siemens MRI imaging systems that enables imaging experts to provide comprehensive scanning assistance to imaging personnel virtually across any distance. The technology allows a technologist to collaborate with up to three scanning workplaces simultaneously, offering real-time knowledge via two-way video, audio and chat functions. Siemens Healthineers designed the Syngo Virtual Cockpit in response to staff shortages, cost pressures and increased focus on patient satisfaction in the diagnostic imaging space. The new technology enables patients to get convenient and timely access to the procedure they need at the location closest to them.

The Vizient diagnostic imaging team had the opportunity to demo the Syngo Virtual Cockpit at a meeting of the Radiological Society of North America. The team was impressed with the innovative functions, displays, controls and ability to complete more specialized types of exams, which have the potential to generate more revenue across multiple imaging clinics. The cockpit allows the expert technologist or radiologist to set up protocols, view positioning and process images to top quality while the staff at the scanner gantry are free to confidently focus on the patient's needs. This technology has the potential to revolutionize staff performance to standardize patient-centric quality across multiple imaging sites.

MRI BioMatrix, Turbo Suite and Dot

Siemens has introduced a portfolio of Magnetom systems designed to embrace human nature. Using BioMatrix Technology, these systems adjust to each patient's unique characteristics, such as different physiologies and anatomies, as well as the way they interact with technology.

The new platform is based on the proven total imaging matrix (Tim) integrated coil technology. Tim 4G systems are more than high-channel coils and feature a completely digital radio frequency architecture with a unique DirectRF design. The system features productivity enhancements for faster patient set-up and easy handling, resulting in up to 40% higher productivity. While Tim 4G provides RF advances for improvements in acquisition speed, Dot, Siemens' unique MRI exam software, combines intuitive protocol management with quality results for each exam. Efficiencies from Dot have resulted in up to 20% shorter exam slots.

BioMatrix is a revolutionary new technology, evolving from Tim, and it consists of three unique technologies – BioMatrix Sensors, BioMatrix Tuners and BioMatrix Interfaces. The new BioMatrix technology delivers the benefit of a faster workflow. BioMatrix systems are able to anticipate motion. Motion is a challenge in MRI because it can significantly decrease image quality, limit scan consistency, and lead to costly rescans. BioMatrix Sensors capture respiratory and head motion, which both boosts consistency and frees up the user to select the optimal exam strategy. This combination ensures high-quality results.

Another advancement in BioMatrix systems is the ability to adapt to challenging anatomies, thereby increasing reliability. BioMatrix Tuners automatically adapt to anatomies that include head and neck, spine and abdomen. Even in difficult scan regions, intelligent coil technology consistently delivers excellent homogeneity and fat saturation. This results in robust, reproducible, high-quality imaging.

Workflow advances include BioMatrix Interfaces, which simplify how the user interacts with the scanner and the patient, accelerating patient preparation. Regardless of patient size or mobility – or technologist experience – BioMatrix Interfaces improve workflow and efficiency. Select&GO, a BioMatrix interface, lets operators use artificial intelligence to automatically position patients up to 30% faster.[1]

BioMatrix systems include breakthroughs in acquisition speed. With Turbo Suite, sequences leverage high-element density coils and unique parallel imaging techniques, delivering a comprehensive neurological exam, including time-of-flight, in 10 minutes. While body imaging is up to 50% shorter, according to Siemens data, breath-holds and high-resolution scans are possible with Caipirinha, another Siemens product.

The Excelerate and Elite Turbo Suites provide further advances with access to the acceleration technologies Simultaneous Multi-Slice (SMS) and Compressed Sensing. Turbo Suite Excelerate introduces a paradigm shift in productivity with up to 50% exam time savings for all contrasts, orientations and body regions and Turbo Suite Elite leverages the potential of Compressed Sensing for dynamic and full, free-breathing examinations.

With these advances in MR technology, clinicians can optimize workflow and scanning efficiency, while providing consistent, high-quality personalized examination results.

GE Healthcare

Critical Care Suite

GE Healthcare's Critical Care Suite is an industry-first collection of artificial intelligence (AI) algorithms for triage embedded on the company's Optima XR240amx mobile X-ray device. Recently cleared by the FDA, Critical Care Suite immediately flags critical cases with suspected pneumothorax to radiologists for triage and subsequently alerts technologists of the findings. Additionally, Critical Care Suite's quality AI algorithms help technologists reduce image quality errors and improve efficiency by simultaneously auto rotating images as well as analyzing and flagging protocol and field of view errors on-device. The Intelligent Auto Rotate AI alone can save highly-trained technologists at a medium to large hospital more than 70,000 manual clicks[2] – that amounts to nearly 20 hours, or three working days a year spent rotating chest images on portable X-ray machines. Additionally, the Intelligent Field of View and Intelligent Protocol Check help detect acquisition errors, flagging images for technologist review and allowing them to make corrections before they are sent to PACS.

Embedding Critical Care Suite on-device also offers several benefits. For critical findings, GE Healthcare's algorithms ensure AI results are generated within seconds of image acquisition, without relying on connectivity or transfer speeds to produce the AI results. Also, automatically running quality checks on-device integrates them into the technologist's standard workflow and enables technologist actions – such as rejections or reprocessing – to occur at the patient's bedside and before the images are sent to PACS.[12]

Philips

Ambient Experience

Philips Ambient Experience is a unique offering that focuses on improving productivity, patient experience and clinician engagement, by creating a human-centric environment in clinical spaces. The solution goes beyond creating an immersive environment with dynamic lighting, projections, audio or other technologies by evaluating the natural flow of work in the department. The Ambient Experience team starts with flow mapping and engaging with staff to identify pain points and bottlenecks, even going as far as monitoring staff heart rates to determine where a positive distraction could ease an unrealized pain point. Department and spatial design is also a part of the solution, as the Ambient Experience evaluates and aligns department spaces for an ergonomic and calming workflow.

The program boasts several clinical studies proving the return on investment of Ambient Experience by reducing rescans and producing shorter scan times and improved patient and staff satisfaction scores. One such study found that Ambient Experience reduced interrupted MRI scans by nearly 75%, which is significant considering rescans cost an average clinic over $100,000 annually.[13] Operationally, Ambient Experience can set your imaging clinic apart with lower waiting times, less rescheduling and reduced staff overtime due to complications in the scan area.

The Vizient Diagnostic Imaging staff was able to check out the PET scan uptake suite with Ambient Experience features at the RSNA conference. Aside from the aesthetic pleasure of the uptake suite, the design of the suite is critical to the diagnostic outcome of the PET scan results. When patients are mentally and physiologically relaxed during their uptake time, the chances of the glucose-based radiopharmaceutical accumulating in unwanted tissue greatly reduced.[14] Avoiding uptake in these non-target areas can reduce the time it takes for physicians to interpret the images, improve the accuracy of disease staging and eliminate the need for costly re-scans.

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Contributors

Adam Fairbourn, BS, CNMT
Portfolio Executive, Diagnostic Imaging

Bri Huedepohl, D.H.Sc., R.T. (R)
Director, Contract Services

Brock Malone
Portfolio Executive, Contrast Media, Injection Systems and Nuclear Medicine

Joni Swartz, MSHSA
Director, Contract Services, Capital and Imaging

Daniel Ward, BSRT (R)
Senior Portfolio Executive

vizient®

290 E. John Carpenter Freeway
Irving, TX 75062
(972) 830-0000

www.vizientinc.com

For more information, contact us at (800) 842-5146
or vizientsupport@vizientinc.com.

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